

species maintained more negative water potentials and had lower whole plant hydraulic conductances than the C₃ species. These results do not support the mesic environment hypothesis outlined above. Measurements made during drought have yet to be investigated.

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A malachite sunbird pollination guild in the Cape flora, with implications for the endangered *Brunsvigia litoralis*

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In the Cape flora there are many specialized pollination systems. Specialization within the bird pollinated syndrome, however, has not been considered before. Plants have traditionally been classified as “bird-pollinated”, but this is a simplistic view, hiding the diversity that exists within the bird pollination category. Here I divide sunbirds into two groups: large and small, according to beak and tongue lengths. Plant species over a range of tube lengths were chosen and were predicted to be pollinated by either small- or large sunbirds based on floral tube length. Through field observation pollinators were determined and as predicted deep flowered species were pollinated solely by the only large sunbird, the Malachite Sunbird (*Nectarinia famosa*) and robbed by smaller avian nectarivours. This was substantiated by seed set data. This specialized pollination systems has important conservation implications; conserving deep-flowered species without conserving *N. famosa* would be to no avail. I used the endangered *Brunsvigia litoralis* as a case study. The study population is fragmented and threatened by human development. The only flower visitor (1.6 visits/flower/hour) *Cinnyris afra* (Greater Double-collared Sunbird) is unable to access the nectar in the usual way due to a long perianth tube (36.7 mm), and resorts to robbing. To substantiate the lack of an effective pollinator flowers were hand-pollinated, which increased seed set by an order of magnitude. I suggest the larger but regional absent *Nectarinia famosa* as the sole pollinator of *B. litoralis*.

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Could the trade-off between plant burial responses and light-competition result in the zonation of dune vegetation?

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It has been suggested that the ability of plant species to respond to burial results in the maintenance of the zonation of coastal dune vegetation. Mobile dunes are typified by species that can respond to burial by increasing growth rates, while stable dunes are dominated by species that show little or no ability to respond to burial. This simple relationship cannot explain why fast-growing mobile-dune species do not dominate the entire dune system. The zonation can be explained if a trade-off exists between a species ability to compete for light or respond to burial. We show that low stem tissue density (the cost of producing a volume of stem) allows mobile dune species to grow fast enough to survive burial, while stable-dune species are unable to respond to burial. Stem density also relates to mechanical strength, thus preventing mobile-dune species with low stem densities from growing tall and competing for light. We suggest that the trade-off of either having “cheap” stems or growing tall, and the niche differentiation that this implies, provides a more rigorous explanation of coastal dune zonation.

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A “Large Infrequent Disturbance” in an East African Savanna

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There is growing interest in Large Infrequent Disturbances (LIDs), but by definition they occur rarely and long-term data are needed in order to study their effects and frequency. Palaeoecological records have the potential to provide information on the effects and frequency of LIDs. By comparing recent sedimentary records with known historical data, the effects of LIDs on pollen, charcoal and sedimentary sequences can be assessed. In this paper, a LID in East Africa is described, and its representation in the palaeoecological record is explored. Historical records show that there was severe drought and famine in East Africa at the end of the 19th Century. Fossil pollen and charcoal records from this period show evidence of a disturbance event that occurred at approximately this time. Statistical comparison of pollen and charcoal data from before, during and after the disturbance event identified it as a LID. The data also suggested that an erosion event occurred part way through the drought, suggesting that an environmental threshold was exceeded.

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Algal culture, from laboratory to commercial production

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A R6 million commercial scale *Spirulina* algal biotechnology production plant was built at Musina, Limpopo Province answering amongst others the South African Government and the Department of Science and Technology call to place South Africa amongst the world leaders in the application of biotechnology and economic empowerment. World-wide the dietary supplement industry is extremely lucrative and amounts to US\$ 23 billion per annum in the USA alone. Major other consumers are the Europeans and Japanese, and the market is growing at around 20% per annum. The transition from the laboratory to large scale production units is not a simple task, with many unforeseen problems, mostly related to scale. Downstream processing, product production, handling, quality and marketing are additional challenges, not experienced at the laboratory scale. The large outdoor production units offer exciting experimental and research possibilities and they were used, amongst others, to follow midday photosynthetic depression and the switching off of reaction centres.

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Preliminary cladistics of the genus *Hermannia* and intriguing morphological adaptations

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A preliminary cladistic analysis of some 100 species of the genus *Hermannia* section Mahernia is presented. Features of the plants are discussed with an emphasis on morphological adaptations to pollination and the environment. Flower colour changes may drive speciation through pollinator shifts, whereas dispersal mechanisms and geological specialisation appear to be key factors in explaining current species distributions.

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Micro-location of elements in leaves of *Leucadendron* 'Safari Sunset' (Proteaceae) with phosphorus toxicity

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Efficient phosphorus (P) uptake by Proteaceae cluster roots is an adaptation to highly weathered soils that are typically low in inorganic P and proteas consequently experience P toxicity at lower rhizosphere P concentrations than do crop plants. This

study aimed to determine the sites of P toxicity in Proteaceae by mapping the distribution of elements in leaf tissue using micro proton-induced X-ray emission spectrometry. Phosphate supply up to 0.01 mM in a fertigation solution resulted in increased stem length of *Leucadendron* 'Safari Sunset' while P concentrations in excess of this resulted in decreased stem length, increased leaf [P] (up to 0.25% (w/w)) and caused typical P toxicity symptoms. In general, P toxicity resulted in increased non-metals P, S, and Si in some tissues, increased halides Cl and Br, and decreased transition metals Fe, Zn, Cu although Mn increased dramatically in some tissues. Phosphorus concentrations in all leaf tissues except the phloem and mesophyll increased in plants supplied with high (5 mM) compared to no (0 mM) added P. While the P concentration in the mesophyll and epidermis of plants supplied with 5 mM P stayed remained low (0.01% (w/w)), those in the xylem cambium were much higher (0.93% (w/w)). High xylem and bundle sheath P concentrations could bind Ca exiting the xylem and/or freely exchangeable Ca present in the middle lamellae of cell walls, resulting in precipitation as CaHPO₄ and causing the observed decrease in epidermal [Ca] and necrosis of leaf margins. Reduced [Fe] in all leaf tissues except the sclerenchyma, as well as increased vascular and bundle sheath [Mn] co-occurred with chlorotic leaves in P-stressed plants while reduced vascular [Zn] co-occurred with leaf rosetting.

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Bioactivity of plant extracts against methicillin-resistant *Staphylococcus aureus*

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The rise of infection caused by 'superbugs' is alarming and one of the most problematic resistant bacteria is methicillin-resistant *Staphylococcus aureus* (MRSA). This bacterium can cause a range of ailments like pneumonia, mastitis, meningitis, urinary tract infection, post operational infection etc. Novel drugs are needed for diseases caused by MRSA due to the toxicity of existing drugs. Ten medicinal plants were investigated for their efficacy against drug-sensitive and drug-resistant strains of *S. aureus*. Ethanol extracts of *Melanthus major*, *M. comosus* and *Dodonaea angustifolia* were found to have good inhibitory activity against both drug-sensitive and drug-resistant strains of *S. aureus*. Minimum inhibitory concentrations of all these plants ranged from 0.391 mg/ml up to 1.56 mg/ml. These active extracts were also tested against a Gram-negative bacterial species, *Escherichia coli*. *M. major* and *M. comosus* both showed a minimum inhibitory concentration (MIC) of 1.00 mg/ml against *E. coli*. Ethanol extracts of all the plants were tested for cytotoxicity on Vero cells using the XTT method. The lead extract, *M. major* had a 50% inhibitory concentration (IC₅₀) of 52.76 µg/ml and was therefore selected